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AUTHOR Webb, Norman L.; And Others
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ABSTRACT

The Urban Mathematics Collaborative (UMC) project has the goal of contributing to the improvement of mathematics education in the inner-city schools by identifying models to enhance the professional lives of teachers and encouraging the entry of high school mathematics teachers into a larger mathematics community including mathematicians from higher education and industry. This document is a 4-year site report on the New Orleans Mathematics Collaborative from its entry into the program in 1986 through June 1990. The intent is to reflect on the development of the collaborative, noting the changes that have taken place in regard to the context in the collaborative operated, the collaborative's management structure, and the focus of its activities. This final site report addresses the major influences exerted on the collaborative and the directions the collaborative has taken. Some conclusions are reached regarding both the collaborative's development and achievements in light of its specific goals as well as the goals of the total UMC project. (MDH)

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December 1991
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NEW ORLEANS MATHEMATICS COLLABORATIVE

FOUR-YEAR SITE REPORT

A Final Report to the Ford Foundation on the Urban Mathematics Collaborative (UMC) Project

Norman L. Webb, Susan D. Pittelman, Thomas A. Romberg, Allan J. Pitman, Edel M. Reilly, and James A. Middleton

Wisconsin Center for Education Research
School of Education, University of Wisconsin–Madison

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Norman L. Webb, Susan D. Pittelman, Thomas A. Romberg, Allan J. Pitman, Edel M. Reilly, and James A. Middleton

Report from the
Urban Mathematics Collaborative Documentation Project

Wisconsin Center for Education Research
School of Education
University of Wisconsin
Madison, Wisconsin

December 1991

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I. INTRODUCTION

This document is a four-year Site Report on the New Orleans Mathematics Collaborative from its inception in 1986 through June, 1990. The intent is to reflect on the development of the collaborative, noting the changes that have taken place over time in regard to the context in which the collaborative operated, the collaborative's management structure, and the focus of its activities. It is not the intent of this report to review the development of the collaborative; this has been done in the annual reports. This final Site Report addresses the major influences exerted on the collaborative and the directions the collaborative has taken. Some conclusions are reached regarding both the collaborative's development and achievements in light of its goals as well as the goals of the total Urban Mathematics Collaborative project.

The Urban Mathematics Collaborative Project

In 1984, the Ford Foundation initiated the Urban Mathematics Collaborative (UMC) project to improve mathematics education in inner city schools and to identify new models for meeting the on-going professional needs of urban teachers. In February, 1985, the Foundation awarded five grants to establish urban mathematics collaboratives in Cleveland, Minneapolis-St. Paul, Los Angeles, Philadelphia, and San Francisco. In addition, the Ford Foundation established a Documentation Project at the University of Wisconsin-Madison to chronicle the development of the new collaboratives and a Technical Assistance Project (TAP) at the Education Development Center (EDC) in Newton, Massachusetts, to serve as a source of information for the collaborative projects (Romberg & Pitman, 1985). During the next 18 months, UMC projects were funded in Durham, Pittsburgh, San Diego, St. Louis, Memphis, and New Orleans, for a total of eleven collaboratives (Webb, Pittelman, Romberg, Pitman, Fadell, & Middleton, 1989). In August, 1987, an Outreach Project was funded at EDC to publicize and expand the UMC effort. In August of 1989, the Ford Foundation awarded replication grants to three additional sites: Dayton, Ohio; Columbus, Georgia; and Milwaukee, Wisconsin. In April, 1991, the fifteenth and final collaborative, the Greater Worcester Urban Mathematics Collaborative, was established in Massachusetts. A map indicating the location of UMC projects is presented in Figure 1.

The
Urban Mathematics Collaborative Project

Funded by The Ford Foundation

- **Cleveland Collaborative for Mathematics Education (C^2ME)**
  Cleveland, Ohio
- **Durham Collaborative: The Durham Mathematics Council**
  Durham, North Carolina
- **Los Angeles Urban Mathematics/Science/Technology Collaborative (LAUM/S/TC)**
  Los Angeles, California
- **Memphis Urban Mathematics Collaborative**
  Memphis, Tennessee
- **New Orleans Mathematics Collaborative (NOMC)**
  New Orleans, Louisiana
- **Philadelphia Math Science Collaborative**
  Philadelphia, Pennsylvania
- **Pittsburgh Mathematics Collaborative**
  Pittsburg, Pennsylvania
- **St. Louis Urban Mathematics Collaborative**
  St. Louis, Missouri
- **San Diego Urban Mathematics Collaborative**
  San Diego, California
- **San Francisco Mathematics Collaborative**
  San Francisco, California
- **Twin Cities Urban Mathematics Collaborative**
  Minneapolis-St. Paul, Minnesota

Replication Sites

- **Columbus Regional Mathematics Collaborative (CRMC)**
  Columbus, Georgia
- **Dayton-Montgomery County Public Education Fund Mathematics Collaborative**
  Dayton, Ohio
- **Greater Worcester Urban Mathematics Collaborative**
  Worcester, Massachusetts
- **Milwaukee Metropolitan Mathematics Collaborative (M^3C)**
  Milwaukee, Wisconsin

Figure 1. The National Network of Urban Mathematics Collaboratives.

During the period covered in this final Site Report, mathematics education in the United States has changed. When the Ford Foundation initiated the UMC project in 1984, a consolidated effort to reform mathematics had not yet begun, although the potential of the mathematics education community for achieving reform was envisioned. In this regard, the UMC project was innovative in mobilizing a group of inner-city teachers to increase both their sense of professionalism and their connections with mathematicians in business and higher education. Between 1985 and 1990, mathematics education in this country began to change dramatically. In an effort to develop a new mandate based on such studies as *Renewing United States Mathematics: Critical Resource for the Future* (Commission on Physical Sciences, Mathematics, and Resources, 1984) and *A Nation at Risk: The Imperative for Educational Reform* (National Commission on Excellence in Education, 1983), the Mathematical Sciences Education Board in 1989 issued *Everybody Counts: A Report to the Nation on the Future of Mathematics Education* and the National Council of Teachers of Mathematics published *Curriculum and Evaluation Standards for School Mathematics*. As the collaboratives matured, the movement to change mathematics education in the country took on momentum, creating a new environment for the collaborative network. What began as a project designed to enhance the professional development of urban teachers evolved into a catalyst for the reform of mathematics education.

At each site, the UMC project supports collaboration among school mathematics teachers and between teachers and mathematicians from institutions of higher education and industry; it also encourages teacher membership and participation in a broad-based local mathematics community. Although the guiding principle behind the UMC effort has been that the teacher is and will remain at the hub of the educational process, it has become evident that many teachers--and especially those in inner-city schools--are overworked; lack support and material resources; and are isolated from their colleagues, from other professionals, and from the rapidly changing field of mathematics. Thus, the focus of the UMC project remains rooted in the premise that collegiality among professional mathematicians can reduce teachers' sense of isolation, enhance their professional enthusiasm, expose them to a vast array of new developments and trends in mathematics, and encourage innovation in classroom teaching.

Structure of the Four-Year Summary

The Four-Year Summary presented in the following chapter is comprised of six sections. The first section provides a brief overview of the collaborative. In the second section, the purpose of the collaborative is presented, as stated in its proposals to the Ford Foundation. The goals outlined in the collaborative's final request for funds to the Ford Foundation are contrasted with those specified in its initial proposal. The third section discusses the context within which the collaborative operated and the extent to which this has remained stable or has changed over the four-year period. Topics addressed in this section include demographic information on the surrounding community, changes in school district administration and enrollment and in the teacher population targeted by the collaborative, and significant changes occurring in mathematics and in the professional environment. The fourth section of the report describes the management structure adopted by the collaborative and changes that occurred in that structure over the four-year period. The fifth section discusses the collaborative's activities in relation to four major themes that emerged as dominant in most collaboratives during the document process: socialization and networking, increased knowledge of mathematics content, teacher professionalism, and teacher leadership. These themes are used as a focus to organize ideas and to help reflect on the collaborative's development with respect to some overriding expectations of the UMC project. The sixth and final section presents the reflections of Documentation Project staff on the approach the collaborative took to achieve its goals and perceived outcomes in the areas of collaboration, professionalism, and mathematics focus.

The information presented in the Site Reports is both a condensation and synthesis of information collected over the span of the UMC Documentation Project. Data were collected through monthly reports, the electronic network, four large-scale surveys, two demographic surveys, site visits, and case studies. These data-collection instruments and procedures are described in detail in the *UMC Guide to Documentation* (Pittelman, Webb, Fadell, Romberg, Pitman, & Sapienza, 1991). Detailed information about the Urban Mathematics Collaborative project is presented in six annual reports, four technical reports, and a set of case studies prepared by the Documentation Project. All of these reports are listed in the References. The Site Reports, which offer a retrospective summary of each collaborative's efforts over the grant period, have not been reviewed by

collaborative personnel and thus present the reflections solely of the Documentation Project staff.

II. FOUR YEAR SUMMARY 1986 TO 1990

A. Overview

The New Orleans Mathematics Collaborative (NOMC), hosted by the Metropolitan Area Committee, was the tenth of the eleven original collaboratives to be established through the UMC project. The collaborative's target population expanded over the four years to the more than 200 middle and high school mathematics teachers in the New Orleans Public Schools (NOPS). Learning from the experiences of the other collaboratives, the New Orleans Mathematics Collaborative developed an organizational structure that consisted of a director, coordinator, Steering Committee, and a Teacher Advisory Council. Influential persons from business and higher education who provided the collaborative with strong connections to both of these sectors served as members of the Steering Committee. The collaborative was administered by a part-time coordinator, who has remained in that position from the collaborative's beginning, and a director who serves in this capacity in her role as the director of the Metropolitan Area Committee Education Fund. During its existence, the collaborative has had two directors. The collaborative has had a good relationship with the New Orleans Public Schools, receiving support from the superintendent and his staff, and maintaining close interaction with the mathematics supervisor. The scope of activities that the collaborative offered teachers changed as the organization matured. Collaborative-sponsored dinner symposiums, summer internships, business and industry site visits, workshops, institutes, and a quarterly newsletter have given teachers the opportunity to better understand mathematics, the applications of mathematics, and recent trends in mathematics education.

A core group consisting of about 50 mathematics teachers has emerged from the NOMC to assume a more active role in advancing the reform of mathematics education in the New Orleans schools. In the fourth year of the collaborative, the Teacher Leadership Council replaced the Teacher Advisory Council. Teachers who serve on the Leadership Council see their role as setting an agenda for action rather than simply operating in an advisory capacity. The major activities of the collaborative in its fourth year centered around the leadership and activities of the Teacher Leadership Council, which worked for visibility not only within the district but within the state. Coinciding with this rise in teacher activity was an increase in teacher awareness regarding the applications of mathematics in business and industry; teachers were also learning new approaches to

teaching mathematics including the use of technology. The district mathematics supervisor began to turn to collaborative teachers to lead workshops for other teachers. The work of the collaborative also gained the attention of the district administration, serving as a model for professional development in other content areas. The New Orleans Mathematics Collaborative has changed the educational environment within the New Orleans area. It has provided both a conduit for area businesses and institutions of higher education to channel their efforts as well as to provide new resources for the district to draw upon, and it has helped mathematics teachers to increase their knowledge of mathematics and their interest in working together to effect change.

B. Purpose

The stated purpose of the New Orleans Mathematics Collaborative has remained consistent over the four years. The collaborative is committed to providing opportunities to teachers in the New Orleans Public Schools that enhance the professional development of mathematics teachers and enrich the teaching of mathematics. The collaborative had four overriding goals for teachers: that they work in collaboration with other teachers and mathematicians as they address their needs and those of their students; that they keep abreast of developments in the fields of mathematics and teaching; that they become part of a network of mathematicians; and that they experience firsthand the ways in which mathematics is used outside the academic setting. In pursuing these goals, the collaborative's strategies were to conduct site visits and internships, to have workshops for enhancing the interchange of information, to provide minigrants for teachers to translate their out-of-class experiences to in-school activities, and to develop a networking mechanism among classroom teachers and other professionals involved in teaching, research, and using mathematics. Initially, the collaborative targeted the 130 senior high school mathematics teachers. In 1989-90, the target group was expanded to include the approximately 100 middle school mathematics teachers in the district.

C. Context

Even though the New Orleans area and the state of Louisiana experienced a depressed economy in the mid-1980s because of the decline in the oil industry, the

population of New Orleans increased 4 percent from 536,300 in 1986 to 557,900 in 1989. The population of the greater New Orleans metropolitan area totaled 1,256,200 in 1989, an increase of about 6 percent in three years. Over this same period, enrollment in the New Orleans Public Schools increased 20 percent from 78,583 to 94,000 students. The ethnic distribution of students enrolled in the district shifted from 86 percent black, 9 percent white, and 5 percent other in 1986 to 90 percent black, 6 percent white, 3 percent Asian, and 1 percent Hispanic and American Indian in 1989. At least 65 percent of the students participated in the government-funded low-cost or free lunch program, and 32 percent were from families receiving AFDC. Over the four-year period, efforts were being made to reduce the dropout rate, which at one point was estimated to be as high as 50 percent of the students entering school.

Dr. Everett J. Williams has served as Superintendent of Schools since 1985. In the 1989-90 school year, the district had 22 high schools, 12 junior high schools, 13 middle schools, and 81 elementary schools. New Orleans has a very strong private and parochial education system that includes nearly as many school buildings as the New Orleans Public Schools. The Orleans Parish School Board has seven members. For the 1989-90 school year, the district's budget was $275 million, an increase of 25 percent from the 1985-86 budget of $219 million. Fifty-six percent of the budget came from state funding, 40 percent from local resources, 2 percent from federal sources, and 2 percent from other sources. During 1989-90, the New Orleans Public Schools employed 5,204 teachers, an increase of 15 percent since 1985. Of the teachers, 58 percent were black female, 20 percent were white female, 14 percent black male, 7 percent white male, and 1 percent were from some other ethnic group. The teachers are represented by the United Teachers of New Orleans, which had negotiated a three-year contract beginning in 1987. The beginning salary for teachers increased from $16,032 in 1985-86 to $17,635 in 1989-90.

The number of mathematics teachers in the middle and secondary schools increased over the four years from about 230 in 1985-86 to 264 in 1989-90. In 1989-90, 70 percent of the mathematics teachers were black, 28 percent were white, and 2 percent were Asian. Nearly two thirds of the mathematics teachers were female. In the 1988-89 school year, 42 percent of the mathematics teachers held at least a master's degree; 84 percent were tenured; and 91 percent held a regular teaching certificate. The New Orleans Public Schools employs one mathematics supervisor.

Over the duration of the collaborative, the requirements for graduation included three units of mathematics--Algebra I, Geometry, and Algebra II. This graduation requirement had been mandated by the state legislature in 1984. However, 46 percent of all Louisiana students who took Algebra I for the first time either failed or dropped the course. In January, 1990, despite objections from the public, an integrated algebra and geometry course was added to the Louisiana high school curriculum (to be implemented in the fall of 1990) that could be used in fulfillment of one of the three mathematics credits. Those who objected claimed that the new course would allow students to avoid taking higher-level mathematics courses. In the middle grades in New Orleans Public Schools, mathematics is not considered a promotional subject; students are not required to pass it in order to proceed to the next grade. This has been regarded as one factor responsible for the high student failure rate in Algebra I for Grade 9. In 1989, amidst other state initiatives, Louisiana's Department of Education and the State Board of Elementary and Secondary Education embarked on an ambitious effort coordinated with local school systems to keep teenagers in school.

Teachers in the New Orleans Public Schools have several opportunities to pursue advanced degrees at special tuition rates. Loyola University offers teachers reduced tuition as an incentive to enroll in a course to support the development of classroom curriculum following a summer internship experience in an area business or industry. The New Orleans Mathematics Collaborative, as an organization, has become involved in community and state activities. In 1987-88, the collaborative joined a consortium with Southern University, the Urban League of New Orleans, and the American Association for the Advancement of Science (AAAS) to establish a Community Learning Center to improve the performance of minorities and women in mathematics and the sciences through the use of computers. The collaborative administration also consulted with the state mathematics supervisor who was generating ideas for the establishment of the Louisiana Mathematics Coalition. Collaborative Steering Committee members from higher education and business also assisted in establishing the Coalition.

D. Management Structure

The New Orleans Mathematics Collaborative, founded in September, 1986, is hosted by the Metropolitan Area Committee (MAC), a non-profit citizen's group whose

membership includes representatives from the business, labor, professional, academic, and religious communities in the greater New Orleans area. Under MAC's organizational structure, the collaborative is administered by the director of the MAC Education Fund. In addition to overseeing the collaborative, administrators of the MAC Education Fund supervise the Community Awareness Project, Partnerships in Education, and the Mini-Grants for Teachers Program. Although the Metropolitan Area Committee has existed since the 1960s, the Education Fund dates only to 1985, having been established in association with other public education funds. Prior to the formal founding of the New Orleans Mathematics Collaborative, a group of community leaders, including representatives from the MAC Education Fund Board, corporations, businesses, and universities, had supported the formation of a collaborative. The continued support of these groups throughout the existence of the collaborative has been instrumental in establishing community-wide ownership of the project.

The administration of the New Orleans collaborative has remained stable over the four years, even though there was a change in directors. Constance Barkley, the first director of the MAC Education Fund, served as director of the collaborative from 1986 until 1988 when she became the Executive Director of MAC. The position she vacated was filled by Kimberly Sawyer, a former public school teacher who had prior experience with non-profit organizations and had recently moved to the New Orleans area. From the beginning, the collaborative coordinator has been Dr. Olympia Boucree, the former mathematics supervisor for the New Orleans Public Schools. The collaborative is provided office space, as well as clerical services, by the MAC.

The governing structure of the collaborative has remained the same from its beginning. The Steering Committee, made up of representatives from business, higher education, teachers, school administrators from the NOPS district, the Teachers' Union, the Louisiana Science Centre, and the collaborative director and coordinator, meets quarterly to monitor and evaluate programs and to serve as a think tank to solve problems and create new initiatives. Dr. Richard Hayes, a bank executive and member of the MAC Education Fund Board, served as the chair of the committee the first year. He was succeeded by R. L. Howard, chief executive officer of Shell Offshore, Inc., who served as chair of the committee through April, 1990. Mr. Howard's successor, Richard Pattarozzi, is also from Shell Offshore, Inc. The Steering Committee is organized into four standing committees, each with a separate chair: the symposia subcommittee, the site

visit/internship subcommittee, the workshop subcommittee, and the newsletter subcommittee. Under Mr. Howard's leadership, each subcommittee developed its own set of goals.

The Teacher Advisory Council, formed during the collaborative's second year, was comprised of one teacher from each high school. This group met on an as-needed basis, as decided by its members. In its first year, the committee was given $5,000 from the collaborative to fund its yearly activities, including all travel grants for teachers to attend meetings. The Teacher Advisory Council met twice during its first year and four times the following year.

During the summer of 1989, four New Orleans teachers attended the Teacher Leadership Workshop in Newton, Massachusetts, conducted by EDC for collaborative teachers. These teachers returned to New Orleans invigorated and flush with ideas. The Teacher Advisory Council was renamed the Teacher Leadership Council and began to meet at least monthly and sometimes more frequently. The change in name reflected the teachers' change in the perception of their role--from that of providing advice on collaborative activities to being responsible for the direction of the collaborative. The collaborative expanded to include middle school teachers, and Council membership was expanded to include one representative from each of the 43 targeted high schools, middle schools, and junior high schools. Appointments to the Council tended to go to those teachers who were most interested in serving.

The work of the Council became more focused. Two of its members drafted an Outreach Grant proposal that was funded by EDC. The Leadership Council identified issues it wanted to address, discussed what the Council's position should be, and then two Council members articulated this view at a meeting of the Orleans Parish School Board. One position the Council took was to object to lowering the standards for graduation requirements by allowing students to substitute a lower level mathematics course for one of the three required--Algebra I, Geometry, and Algebra II. Other issues addressed by committees of the Council included the implementation of the NCTM *Curriculum and Evaluation Standards*, pupil progress in the middle grades, and a mini-conference to be held the next fall. During 1989-90, the Teacher Leadership Council took more responsibility for the activities of the collaborative, reflecting an evolutionary

development in the role of teachers. The Steering Committee assumed a more advisory role, with many of the activities that were planned through its subcommittees being curtailed. After four years, the management structure of the New Orleans Mathematics Collaborative shifted to grant teachers a greater role in decision making in cooperation with the collaborative director and coordinator and under the watchful eyes of Steering Committee members.

E. Project Activities

Over the four-year period 1986-1990, the New Orleans Mathematics Collaborative sponsored a wide variety of activities for secondary mathematics teachers in the New Orleans Public Schools. At the beginning of the 1989-90 school year, the collaborative expanded its membership and its programming to include the nearly 100 middle school and junior high school mathematics teachers in the district.

The collaborative's activities addressed the four themes that had emerged during the documentation process as being dominant in collaborative programming. These themes were: Socialization and Networking, Increased Knowledge of Mathematics Content, Teacher Professionalism, and Teacher Leadership. Socialization activities, especially prominent in the formative years of the collaboratives, were designed primarily to initiate interaction among teachers and between teachers and mathematicians from business and higher education. These generally large-group activities were important to a collaborative's evolution since they brought members of the mathematics community together, enabled them to get to know one another, and promoted networking. The second theme, Increased Knowledge of Mathematics Content, encompassed activities designed to provide teachers with mathematics-directed experiences and to increase the knowledge of teachers and others regarding current trends in mathematics and mathematics education. Many of these activities served to activate the agenda of mathematics reform at the collaborative sites. The third theme, Teacher Professionalism, involved activities structured to enhance teachers' conceptions of teaching as a profession. Collaboratives provided opportunities and incentives for teachers to attend professional organization meetings and made mathematics teachers aware of available grants and other opportunities for professional development. Some collaboratives paid teachers' dues for organization membership and arranged for teachers to observe other teachers and reflect on their

teaching. The fourth theme, Teacher Leadership, had not been identified at the beginning of the UMC project, but gained greater attention as collaboratives found that teachers lacked the skills needed to organize professional efforts, to plan, and to develop the power within their group to generate systemic change. This theme was advanced by the EDC through the UMC Teacher Leadership Workshops which, beginning in the summer of 1989, were attended by from one to four teachers from each of the collaboratives. However, since this training was initiated by EDC rather than by the collaboratives, it is not included in the discussion of activities for the individual collaboratives.

In reflecting on collaborative activities as they related to the four themes, considerable overlap was noted, since most activities served multiple purposes. A single activity may, therefore, be referenced under several headings.

Socialization and Networking

One of the goals of the New Orleans Mathematics Collaborative was to help teachers become part of a network of mathematicians by establishing linkages with other New Orleans Public Schools mathematics teachers, as well as with mathematicians from the business and higher education communities. Shortly after the collaborative was established, teachers, principals, school district personnel, and key representatives of the New Orleans business and university communities were invited to a reception to officially launch the collaborative. The inclusion of mathematicians from other sectors at this initial event set the tone for the involvement of business and higher education throughout the collaborative's programming.

Symposia

In the collaborative's initial years, symposia were an important component of its programming. The symposia provided an informal atmosphere in which teachers were able to interact with one another and with colleagues from business and higher education, discussing educational issues that were of concern to all three sectors. Beginning in the 1986-87 school year and continuing through the 1988-89 school year, the collaborative sponsored two symposia annually. In all, the collaborative sponsored six symposia, with

attendance totaling over 600 people, with good representation generally from the business and university communities.

The kick-off symposium, "Mathematics for All," which was held in December, 1986, featured a panel discussion on the uses of mathematics. As was the case for most such events, panelists included a teacher and representatives from business and higher education. The April 1987 symposium featured Dr. Ross Finney, senior lecturer at MIT, who spoke on Professional Applications of Precalculus Mathematics. Following dinner, a teacher and a business person responded to Dr. Finney's remarks. The topics addressed at the two dinner symposia held during the 1987-88 school year were "Mathematics: A Successful Entree to the World of Work," and a draft of the curriculum standards being proposed by the National Council of Teachers of Mathematics. The format of the symposium was modified for the 1988-89 school year to incorporate discussion groups following the presentation. The two symposia held during 1988-89 are discussed later in the Activities section, since their primary focus was on developing teacher professionalism and teacher leadership.

In the beginning, the symposia, which were planned and evaluated by a subcommittee of the Steering Committee, served as important social functions and as forums for attracting people to the collaborative. However, they were also expensive. In the 1989-90 school year, the collaborative turned to more focused small group activities.

Collaborative Newsletter

During its first year, the collaborative initiated the publication of the *NOMC Newsletter*, distributing it to the approximately 150 secondary mathematics teachers as well as to collaborative Board members, MAC Board members, business partners, and school district administrators. The newsletter announced upcoming events, reported on past collaborative activities, offered commentary from teachers, provided articles on topics in mathematics, and served as a vehicle for teachers and business representatives to express their views on the collaborative in general. The collaborative had hoped to publish four issues of the newsletter each year; however, this goal was not met. Under the auspices of the Newsletter Subcommittee, seven newsletters were published over the three-year

period, 1986-1989. Because of problems involved in producing a newsletter with volunteers and due to the lack of resources, the subcommittee decided in 1989 that the newsletter was not a viable tool for networking and recommended that it become a supplement distributed annually to active collaborative members.

Increased Knowledge of Mathematics Content

The collaborative did not have a formal mathematics focus; rather, the emphasis of collaborative programming, especially during the last years of documentation, was on the professional development of teachers. Over the four-year period, activities were designed to help teachers become more knowledgeable about how mathematics is used in the workplace, to become familiar with the uses of technology in mathematics education, and to identify the current trends in mathematics reform as described in the NCTM *Curriculum and Evaluation Standards*. In addition to planning activities for teachers, the collaborative also sponsored an issue-oriented luncheon meeting for community leaders to inform them about the national mathematics education reform movement.

Site Visits

A key component of collaborative programming during its first three years was the teacher site visit to area businesses and industries. The visits provided teachers with an opportunity to view firsthand how mathematics is used in business and industry and to learn about potential opportunities for their students. The New Orleans Public Schools provided release time so teachers could participate and acquire practical skills and information they could apply to their classroom teaching. Prior to each site visit, the collaborative coordinator made contacts to discuss the collaborative's expectations of the visit. Each host then planned the day's agenda and activities, including lunch. Between 1986 and 1989, the collaborative hosted 16 site visits to 6 area industries: the New Orleans Public Service, Inc., and Louisiana Power and Light; Shell Offshore, Inc.; Freeport-McMoRan, Inc.; Consolidated Natural Gas Company; D.H. Homes Department Store; and the United States Department of Agriculture Southern Regional Research Center. While an attempt was made to have as many different teachers as possible attend the site visits,

in some mathematics departments the department chair went on more than one visit. Approximately 125 teachers participated in the site visits, although the absolute number of teachers was considerably less since many of the teachers participated in more than one visit. A collection of mathematical concepts and problems gathered from site visits is being compiled so that all collaborative teachers are able to use the information shared during the visits. While teachers found the site visits to be beneficial, by the end of the 1988-89 school year teachers were becoming more interested in direct "hands-on" experiences, and enthusiasm for the site visits dwindled. As a result, site visits were not scheduled for the 1989-90 school year.

Workshops, Seminars, and Institutes

Workshops provided NOMC teachers with the opportunity to acquire new ideas about mathematics and teaching. Over the four-year period, the collaborative sponsored 7 workshops that, in total, were attended by approximately 130 collaborative teachers. The workshops varied in length and attendance from a three-hour session attended by 8 high school teachers to one-day workshop attended by 38 upper elementary teachers to a week-long workshop attended by 11 junior and senior high school teachers. During the 1986-87 school year, the collaborative sponsored three workshops as part of the NOPS mandated inservice program. The workshops topics were problem solving, mathematics anxiety, and the use of calculators and computers in the classroom. Two of the workshops were taught by professors from local universities, and one was presented by a mathematics teacher from Benjamin Franklin High School. Attendance at the three workshops was lower than anticipated, with only 8 to 10 teachers attending each one. The collaborative's Steering Committee recognized that the workshops were less popular than other NOMC activities and agreed to address the selection of workshop topics, as well as to try to promote the workshops as mini-courses or seminars.

During the 1987-88 school year, the collaborative sponsored two workshops, a one-day event on the *Geometric Supposer* and a five-day workshop, "Introduction to Pre-Calculus Materials," at which the materials produced by the North Carolina School of Science and Mathematics (NCSSM) were presented. The first workshop, which was attended by 18 teachers, was conducted by Dr. Richard Houde, a teacher from

Massachusetts who was one of the software program's developers. The week-long workshop, attended by 11 junior and senior high school teachers, was presented by 2 NOPS high school teachers who had received collaborative funding to attend a training session at NCSSM during the summer of 1987.

In 1988-89, a total of 75 elementary school teachers and department chairs attended one of two workshops given by Dr. Arthur Powell of Rutgers University. The workshops provided a hands-on opportunity for teachers to implement strategies for using writing as a vehicle for teaching mathematics that Dr. Powell had presented in a symposium held prior to the workshops. The collaborative did not sponsor any workshops during the 1989-90 school year, although 17 collaborative teachers were asked by the district mathematics supervisor to conduct workshops for other district teachers in June, 1990.

In March, 1989, the collaborative co-sponsored a seminar on helping students to overcome their anxieties about studying science and mathematics, presented by Dr. Jeffrey Mallow of Loyola University in Chicago. The seminar was attended by nearly 100 mathematics and science teachers from the Orleans and Jefferson school districts, including several collaborative teachers. The other co-sponsors of the activity were the Louisiana Science Centre and Shell Offshore, Inc.

The collaborative co-sponsored a Woodrow Wilson National Fellowship Foundation Summer Institute on Geometry, in conjunction with the New Orleans Public Schools in August, 1988. Twenty-one teachers participated, and although no stipend was offered, there was a waiting list. The collaborative also co-sponsored the 1989 Institute on Statistics in Society, which was attended by 17 collaborative and 3 non-collaborative teachers. A Woodrow Wilson Summer Institute on Algebra was planned for August, 1990.

Mathematics Curriculum Reform Luncheon

In 1989, the collaborative sponsored a luncheon meeting and discussion forum for community leaders on the topic, "What business, school administration, and universities can do to support mathematics curriculum reform." The luncheon was attended by 29 people, representing a wide spectrum of the New Orleans community's education and

business leadership, as well as national mathematics education leaders. The meeting provided an opportunity for representatives of the New Orleans education and business communities to learn about the national mathematics reform movement from those at its forefront. This type of event was successful in promoting community support for the collaborative.

Teacher Professionalism

From its beginning, the New Orleans Mathematics Collaborative has placed major emphasis on enhancing the professional development of mathematics teachers in the New Orleans Public Schools. The collaborative has provided teachers with opportunities for professional growth that were not previously available to them, including summer internship experiences, programs and informal gatherings to address key pedagogical issues, and funding to attend professional meetings and conferences. The collaborative also encouraged teachers to make use of the Mini-Grant Program offered by the Metropolitan Area Committee Education Fund.

Internship Program

During the 1987-88 school year, the collaborative, in conjunction with Loyola University, initiated the Industry Internship Program. The program is designed to give teachers the opportunity to work in a business environment with the anticipation that they will return to the classroom with more creative teaching skills, techniques, and real-world applications. The program also provides an opportunity for teachers to put their professional knowledge of mathematics to practical use. During the summer of 1988, the first year of the program, two senior high school mathematics teachers worked as assistant statistical analysts at the Port of New Orleans. In August, 1988, to attract additional businesses to participate in the Industry Internship Program, the chair of the NOMC Steering Committee who was chief executive officer of Shell Offshore, Inc., hosted a breakfast meeting for business executives. In the summer of 1989, 11 secondary science and mathematics teachers, selected from a pool of 25 applicants, served as summer interns at the U.S. Department of Agriculture's Southern Regional Research Center (SRRC), the First National Bank of Commerce, Freeport-McMoRan, and Shell Offshore, Inc. The

interaction between the interns and their mentors continued throughout the following year. In February, 1990, for example, participating teachers and mentors as well as representatives from the host businesses, were guests at a collaborative-sponsored reception held in their honor. At the reception, the teachers had an opportunity to share their summer experiences. It had been anticipated that all of the organizations that had hosted interns during the summer of 1989 would continue with the program, but only two of the organizations agreed to host interns in the summer of 1990.

Since one of the objectives of the Internship Program is for teachers to transfer elements of their internship experience to the classroom, the collaborative, in conjunction with Loyola University, is continuing to investigate the creation of an academic coursework component of the program, which would focus on developing classroom materials. Participating teacher interns will be eligible for reduced tuition.

End-of-Year Planning Meetings

In 1987, and again in 1989, the collaborative sponsored meetings at the end of the school year that allowed teachers to address important issues that either related to the collaborative or were of pedagogical concern. In May, 1987, the collaborative sponsored a meeting for all NOMC teachers to provide an opportunity for them to evaluate the first year of the collaborative. In addition to offering constructive comments on various aspects of the collaborative's programming, the teachers voiced an interest in having the opportunity to formulate a cohesive policy statement about "where we are as math teachers." This meeting was a major impetus for the formation of the Teacher Advisory Council, established in the fall of 1987.

In June, 1989, the collaborative sponsored a gathering for collaborative teachers, "Come, Relax, Share and Plan," to enable them to address issues of equity. A list of discussion questions had been circulated with the invitation. The collaborative's representatives to the 1989 UMC Teacher Leadership Workshop summarized the thoughts and suggestions of the 17 teachers who were present and brought them to the UMC Leadership Conference to share.

Dinner Symposia

As the collaborative matured, it began to provide programming that gave teachers an opportunity to address key pedagogical issues. During the 1988-89 school year, the collaborative sponsored two dinner symposia. The Fall Symposium featured Dr. Arthur Powell of Rutgers University, who spoke on "Strategies in Working with Underprepared Students." Approximately 110 junior and senior high school mathematics teachers, school administrators, and representatives from the business and university communities attended the symposium. On each of the two days following the symposium, Dr. Powell held workshops to guide teachers in learning to implement the strategies he had presented at the symposium. The workshops were discussed under the heading, "Increased Knowledge of Mathematics Content." Information about the Spring Symposium, which focused on leadership training, is presented later in the Project Activities section under the heading "Teacher Leadership."

Mini-Grants

The collaborative encouraged and supported teachers in taking advantage of the Mini-Grant Program of the Metropolitan Area Committee Education Fund. The program, which was designed to recognize the initiative and creative potential of individual teachers and to invest in classroom projects that would enhance learning opportunities for students, supports the creation and implementation of programs that expand textbook lessons. Grants of approximately $500 are awarded to teachers annually on a competitive basis; applications are due by July 7 of each year and awards are announced in the fall. During the four-year period covered by this report, mini-grants totaling $10,500 were awarded to 21 middle, junior, and senior high school mathematics teachers. In addition, four mini-grants that addressed the teaching of mathematics were awarded to elementary school teachers during the 1989-90 school year.

The Mini-Grant program enables teachers to implement innovative and creative school projects. One teacher used her grant to help students relate what they learn from the textbook to the mathematics they will use in future jobs. She also gave students opportunities to learn about mathematics-related careers. Another teacher used his grant to establish a Mathematics Applications Room that is used by all teachers and students on

a rotating basis. Teachers bring their students to the room to acquire hands-on experiences in mathematical concepts. One of the elementary teachers who received a grant in 1990 used it to help parents of at-risk pre-kindergarten children in developing and implementing a plan to enhance their children's mathematical abilities.

Travel Grants

The collaborative encouraged teachers' attendance at professional meetings and provided financial assistance to support their participation. Beginning with the 1987-88 school year, the NOMC allocated funds to the Teacher Advisory Council for travel grants that would enable teachers to attend national and regional conferences and workshops. The Council was responsible for deciding which teachers were to receive the funds. The Teacher Advisory Council received $5,000 in 1987-88 and $2,500 in 1988-89, at which time the Council decided to give priority to those teachers who had not previously received financial support. In the 1989-90 school year, the NOMC allocated $5,000 to the newly formed Teacher Leadership Council to fund travel grants. Over the four-year period, 57 teachers received grants. Among the conferences that teachers attended with travel grants were: a twelve-day workshop at the North Carolina School of Science and Mathematics (NCSSM) during 1987-88 that focused on the new fourth-year mathematics curriculum the NCSSM mathematics department is developing; the National/Local Action Conference on Science, Mathematics, and Technology Education in Virginia, which focused on forming and maintaining coalitions and collaboratives; National Council of Teachers of Mathematics Regional Conferences and the 1988, 1989, and 1990 Annual Meetings of the National Council of Teachers of Mathematics; the Mathematics Reform and Teacher Professionalism Conference at the North Carolina School of Science and Mathematics in Durham--"Leading Mathematics Into the 21st Century"; a meeting on the NCTM *Standards* in Dallas, Texas; and the Louisiana Teachers of Mathematics meeting in Alexandria in March, 1990.

Teacher Leadership

Toward the end of the 1988-89 school year, the collaborative began to make a concerted effort to develop the leadership capacities of teachers. In addition to actively involving teachers in developing the permanence proposal, the collaborative sponsored a symposium, "Building Leadership; Issues in Equity, Excellence, and Mathematics Curriculum Reform," in May, 1988. During the symposium, the participants divided into subgroups to discuss the dilemmas experienced in their daily work, to make recommendations for future collaborative work, and to suggest possible reform activities to improve mathematics instruction and outcomes for students.

At the beginning of the 1989-90 school year, the Teacher Advisory Council became the Teacher Leadership Council to reflect the fact that the teachers viewed themselves as responsible for the direction of the collaborative, rather than being responsible solely for providing advice on its activities. The Council began to meet monthly and served as a forum for teachers to discuss a wide variety of issues and to identify Council positions on these issues. As a consequence, the teachers have become more vocal and politically active in district decisions.

In April, 1990, the Teacher Leadership Council began planning a two-day mini-conference, scheduled for November, 1990. The agenda for the conference, "Mathematics Alliance Triad for Humanity," featured keynote speaker Manuel Fernandez of the Wayland Public Schools, Wayland, Massachusetts. Dr. Fernandez had spoken at the UMC meetings held during the 1990 Annual Meeting of NCTM. The conference was also designed to showcase New Orleans mathematics teachers, since most of the sessions were to be conducted by collaborative teachers.

The district mathematics supervisor credits the collaborative with creating a larger pool of mathematics teachers from which she can choose individuals to present workshops and assume other leadership roles. At the request of the mathematics supervisor, 17 collaborative teachers conducted workshops for other district teachers in June, 1990. The 12 workshops, which were open to all mathematics teachers in the district, were attended by a total of 298 teachers. The workshops provided a forum for collaborative teachers who had attended activities sponsored by the collaborative to share what they had learned with other teachers in the district.

During the 1989-90 school year, members of the Teacher Leadership Council prepared a proposal in response to a request for proposals for UMC Outreach Action Grants. The proposal was reviewed and approved by the full Council. The goal of the proposal, "Teachers Trained to Lead," was to organize, train, and mobilize mathematics teachers in Grades K-12 to discuss educational issues, pursue policy initiatives at the state level, and influence state policy makers. Using the $10,000 in funding awarded through the grant, teachers would attend legislative sessions and other state education meetings in their efforts to influence decision-making committees with authority over the state curriculum and other issues related to the teaching of mathematics.

F. Reflections

The expressed intent of the New Orleans Mathematics Collaborative to enhance the professional development of mathematics teachers and to enrich the teaching of mathematics by providing a broad array of community-based opportunities to teachers remained essentially unchanged over the four years documented. What did shift over time was the collaborative's programming and the role teachers assumed in collaborative decision making. At the end of the four years, collaborative leadership was not as intent on providing teachers with opportunities as it was on having teachers decide what they wanted and then advancing their own ideas. The program was modified from large-group gatherings such as site visits and the symposia, which were partly designed to make teachers aware of the collaborative, to more intense activities that included internships, institutes, and political action. A large percentage of high school mathematics teachers participated in at least one activity in the early years of the collaborative. In the fourth year, the collaborative tried to gain the involvement of at least one teacher from each targeted school. Thirty or 40 mathematics teachers, many of them middle school teachers who had recently become eligible to participate, became the major focus of collaborative activities. Many of the teachers who formed this core group spent numerous hours strategizing and drafting proposals. A collaborative envisioned initially to generate opportunities for teachers grew into one where teachers became much more active professionally and began to generate their own opportunities.

This evolution on the part of the teachers has to be considered one of the important successes of the New Orleans Mathematics Collaborative. Mathematics teachers

are turning to each other more frequently to serve as resources. The collaborative has also successfully retained the involvement of people from business and higher education over an extended period of time. New Orleans has been more successful at this than many of the other collaboratives. There seem to be several factors that have helped to maintain the interest of this group. One is that many of its members were involved in the early stages of planning for the collaborative and at that time made a commitment to the collaborative. Another factor is that many of them had specific duties to perform, such as planning symposia or developing site visits, through the work of the standing committees. A third factor is that people from higher education and business saw a need and understood that if the collaborative improved the schools in New Orleans it would be healthy for the community in general. Many New Orleans teachers have been exposed to how mathematics is applied in industry and businesses; some of this information has found its way into classrooms. Teachers have learned about new approaches to teaching mathematics, including the use of technology, but have been restricted in applying these ideas because of a lack of resources and a strong emphasis on improving scores on computation-based standardized tests. The district has benefited from having a group of teachers who have attended a range of workshops and who can now be used to present district workshops and to provide leadership to other teachers. Thus, the collaborative has served as a catalyst for a variety of activities in mathematics education in New Orleans; it has also served as a vehicle by which representatives from the different sectors could address many of the issues facing education in New Orleans.

The New Orleans Mathematics Collaborative fell short of its expectations in some areas. No matter how extensive the effort to reach all of the secondary mathematics teachers, including scheduling a variety of activities and personal visit to schools by the coordinator, not all of the teachers were motivated, or chose, to participate. In many cases, these hard-to-reach teachers were the ones who were less experienced in mathematics and could have benefited from updating their knowledge. These teachers were aware of the collaborative but did not participate for a variety of reasons. Another challenge, one that was not addressed by the collaborative, was that of achieving greater cohesion among teachers within a mathematics department. The activities coordinated by the collaborative were directed primarily toward individual teachers. Although a group of teachers from a department would sit together at a symposium, there was no real attempt to build department unity. As a consequence, the benefits received by individual teachers did not always filter through to other members of the department. In some cases, this was

the result of a conscious decision, as when only one department member could go on a site visit (and it was always the department head). There is also the question of whether the collaborative has been able to affect significantly the teaching of mathematics in New Orleans. Knowledge of mathematics is not equally distributed among the teaching force; some departments had a difficult time finding a teacher who felt comfortable teaching the geometry course. This seems more an issue at the regular high schools than in the magnet programs. Another issue not really addressed was that of the many constraints imposed on mathematics teachers, such as teaching six classes a day, being required to spend one day out of the week reviewing old multiple-choice standardized tests, and not allowing students to use calculators because they cannot be used on the tests. The collaborative, however, was able to reach individual teachers who have made changes in how they teach mathematics, and toward the end of its fourth year, the collaborative was doing more strategic planning as a result of identifying program constraints. The collaborative did not have a great deal of impact on structural constraints that are imposed on mathematics instruction by school, district, and state policy.

In retrospect, there are few changes to recommend. Having benefited from the experience of other collaboratives, the organizational structure established for the NOMC was very sound and engaged the participation of people from all of the sectors. The collaborative's activities provided teachers with experiences that were valuable, although they did not form a cohesive program directed toward structural changes until toward the end of the four years. At this point, greater coherence among programs was attempted, such as having discussion groups or a workshop following a symposium so that teachers could reflect on program content and discussion. There is strong pressure on a collaborative to "get the show on the road" and get activities going. The collaboratives need to offer programs to enhance their visibility and develop teachers' confidence in the collaborative's commitment. The pressure to begin programming, however, prevents collaboratives from taking time at the beginning to identify the specific needs to be addressed and to develop a coordinated program so that all components work toward meeting the identified need. This happened in New Orleans to some degree: It took two to three years for teachers to understand the potential for collaboration and what a mathematics collaborative could mean. Once its identity was firmly established, the collaborative's program achieved more coherence. The question remains as to whether this timeline could have been shortened: If the collaborative had identified clearly specified needs earlier, could more have been accomplished over the four years? Finally, depending

on department heads to provide leadership and to disseminate information to their department members did not always work. Implementing a strategy to engage all of the members of a mathematics department, such as having whole departments mount a project or address a pressing problem, would have helped departments work together as a group. These reflections, however, represent four years of observation. What was accomplished by the New Orleans Mathematics Collaborative in energizing a strong core of mathematics teachers is, in and of itself, impressive.

Collaboration Outcomes

The New Orleans Mathematics Collaborative has achieved positive outcomes in the area of collaboration: an increasing number of mathematics teachers in the district are working together more closely; teachers are serving as summer interns to the mutual benefit of teachers and the business; and the model of staff development generated by the collaborative has gained the attention of both the district administration and the state legislature. The greatest achievements of collaboration were the collegiality created among the teachers and the development of a close working relationship among those on the Steering Committee. The collaborative helped teachers from across the district get to know each other and begin to use one another as resources. The symposia were one type of program that helped to strengthen this feeling among the teachers. The manner in which the collaborative's programs were planned and carried out has communicated to teachers that they are part of a supportive group of colleagues and are appreciated. The symposia were particularly important in the beginning because they attracted teachers to the collaborative and provided social and informal experiences both for teachers from within the same schools and for teachers interacting with those from other schools, as well as with representatives from business and higher education. A business person, supporting the value of being able to talk with teachers, reflected on a social event held for the interns and their mentors; ". . . having a drink in a nice setting after a business meeting . . . and talking to teachers is of equal or more value than a business session . . . it certainly pumps them up if nothing else."

The summer internships were particularly successful in providing a valuable experience to teachers and support to the participating businesses. An appealing feature of the internships is that they do not require significant collaborative funding. Locating

businesses and matching their needs with a teacher does, however, require a great deal of effort. Through the internships, participants learned how to use computers, increased their confidence, and gained a new perspective on teaching. Sometimes the gains for teachers affected their outlook toward teaching in general, as well as providing them with broader applications of mathematics. The collaborative director commented on the response of an intern to his experiences and how they had changed his view toward his teaching, "He said that he had learned another degree of patience, that he had to be more patient with his students because he was the learner for a few weeks. He saw that he wasn't as patient as he could have been with his students when he was the facilitator and they were the learners." The participating businesses also benefited from the experience. The Southern Regional Resource Center of the United States Department of Agriculture recognized that getting minorities and women with the needed skills more interested in working in their laboratories was an important goal. Working with teachers through the internship program was seen as a means of reaching students to gain their interest. By hosting a summer intern, an oil company gained an advocate for the environmental work that the company was doing. In learning what the oil companies were doing to protect the environment, the teacher changed his opinion about the efforts that were being made by such companies. As a consequence, this teacher was asked to write a letter to a newspaper editor in response to a negative editorial about the oil company's environmental program. Another teacher prepared a very useful report for the Port of New Orleans on the import and export of coffee. These experiences attest to the mutual benefits of internships for both the teachers and the businesses.

The collaborative has provided the district and, to some extent, the state with a model for working with teachers and for developing programs that draw on interaction among teachers and representatives from business and higher education. The district administration now sees collaboration as a viable approach for professional development that could be used in other content areas. The state mathematics supervisor has drawn on some of the experiences of the NOMC and the expertise of its members in planning a state-wide coalition. In these ways, the collaborative has reached beyond its boundaries to make overtures to others. The fact that others are interested in what the collaborative does is one indicator of its success.

Professionalism Outcomes

During the 1989-90 school year, a core of 30 to 50 teachers became much more involved in decision making and assertive in addressing district and state policies through their work on the Teacher Leadership Council. As a result of their collaborative participation, these and other teachers became more aware of national trends in mathematics education and of applications of mathematics. A consequence was that secondary mathematics teachers in New Orleans developed greater enthusiasm for their work and their status in the community. This phenomenon was noted by some of the business associates. One reported, "I think the [collaborative] has generated enthusiasm among a lot of teachers. . . . From that standpoint the [collaborative] has been successful." Beyond increasing enthusiasm, others note an expanding group whose members have become better informed and are willing to serve as a resource for each other and for the district.

The district administration has been impressed with the staff development opportunities that the collaborative has provided. As a result of its staff development efforts, the collaborative has been able to unify teachers. The district has built upon and taken advantage of the experiences that the teachers have had. The assistant superintendent has worked to develop a means for having teachers who attended professional enrichment activities share this information with other teachers who will work on behalf of peer support groups. She has also used the collaborative as a model for science teachers in preparing an application for a grant. In this way, the administration anticipated that the mathematics collaborative's influence could be extended in the district. Both the collaborative director and the chair of Teacher Leadership Council have been appointed to a committee to address mathematics graduation requirements in New Orleans.

The district mathematics supervisor has noted an increase in teacher leadership activity among the mathematics teachers. She sees it in their willingness to address issues and to take initiative in generating change. She feels that the collaborative has created a larger pool of mathematics teachers from which she can choose individuals to assume leadership roles, such as giving workshops. One mathematics department chair confirms that through the collaborative she has become more assertive, "When I say to be more assertive, I do not mean to have any more influence, at least in my situation, but I have come up with means of organizing myself to at least let the administration know where I'm

coming from . . . Many of us have become more bold in presenting the issues and getting [the administration] to acknowledge that this is a viable issue." The collaborative has equipped teachers to take command, to take action.

The collaborative has also given teachers the opportunity to use each other as resources. One teacher reported that the collaborative had enhanced his professional life, "It has allowed me to exchange ideas with other teachers. It allowed me to go to the national teachers convention last year and I got a lot of great ideas from that." Another teacher also valued the support she has received from other teachers, ". . . the collaborative is good because we all communicate and help each other." She went on to describe the initiatives teachers are taking, including their intention to lobby at the state capitol and to work with the elementary teachers.

During the 1989-90 school year, empowered by their activity on the Teacher Leadership Council, teachers have become more vocal and politically active in district decisions. The Council chose as one of its priorities making mathematics a promotional subject so that students will reach high school better prepared to take Algebra I. In March, 1990, the Orleans Parish School Board met to decide whether the district should continue to require students to pass Algebra I, Geometry, and Algebra II for graduation, or whether it should give students a choice of which three mathematics courses they would take. The superintendent of schools favored student choice. The mathematics teachers felt that this would lower standards and would not be in the best interests of the students. At a meeting of the Council, the teachers formulated their position, and then, at the School Board meeting, two collaborative teachers spoke against choice. The choice option was defeated. This was the first time that mathematics teachers had worked together to develop a position and present it to the Board. Such advocacy had the effect on the teachers of being very reinforcing. The collaborative's coordinator regarded the teachers' presentation as an example of how willing they had become to speak up for what they believed, rather than to merely accept what they are told.

The teachers participating in the collaborative who responded to the 1990 administration of the Survey of Teacher Professionalism saw themselves as dedicated to an occupation of great social benefit that is not given due recognition by the community at large. This characterization applied regardless of how active the teachers had been in the collaborative. With the exception of a small minority, New Orleans mathematics teachers

saw themselves very much as teachers first and as mathematicians second, although this did not reduce the importance with which they viewed continued training in mathematics, teaching skills, and classroom management. Virtually all of the respondents felt very comfortable in their interactions with mathematicians and other users of mathematics. There was general support for the view that teachers were able to exercise sufficient control over their day-to-day decision-making activities, but this was not a universally held position. Opinion was divided as to whether primary responsibility for self- and peer-review should rest with mathematics teachers: Frequent participants in collaborative activities were less inclined to agree. There was strong support from a majority of the teachers for professional organizations to have a primary role in setting standards and in implementing reforms, although a small but significant number of teachers held a contrary view. The great majority of respondents saw professional organizations as providing relevant support to ordinary classroom teachers and they made some use of their publications and activities. This was more pronounced for those who were identified as frequent collaborative participants.

The collaborative has helped to empower a group of teachers by helping them to develop a strong supportive reference group and to feel better about what they are doing. Teachers continually speak about the barriers in the system caused by lack of resources, by state requirements, and by the state-controlled curriculum. One teacher put it this way, "Working in a system like New Orleans is like everybody is stepping on you. It makes you think you're not an important person." She went on to indicate that being in the collaborative provided teachers with an opportunity to share ideas and made her realize that help is available, "It makes you feel that you're worth something again . . . you feel good again . . . you feel better about what you do." The collaborative has brought change in at least one core group of teachers who, rather than going along with the status quo, now have input into the decisions being made. These teachers no longer complain about the system, but are identifying problems, setting priorities, and then working on solutions to the problems. There is no question but that the collaborative has made a significant impact on the professional lives of this core group of teachers.

Mathematics Focus Outcomes

The mathematics focus of the collaborative can best be described as mathematics education reform. No formal focus was adopted; rather, the emphasis was on the professional development of teachers. Activities have ranged from having teachers become more knowledgeable about how mathematics is used in the workplace to identifying the current trends in mathematics reform as described in the NCTM *Curriculum and Evaluation Standards*. The teachers have become advocates of educational policies that directly affect the quality of education for their students, such as changes in graduation and promotional requirements.

Teachers have applied the knowledge they have gained from collaborative activities and workshops and report that they have made changes in their classrooms. Teachers who attended the one-week Woodrow Wilson Summer Institutes report that as a result they are incorporating statistics and probability in their classes and are approaching geometry differently from the way they approached it in the past. For example, at an institute one New Orleans teacher saw that the presenters did not emphasize formal proofs in their geometry classes, but stressed justifying a theorem by a case or example. Later, this teacher reported, "I have found this way of proving much easier to teach and more practical." Other teachers acknowledge that the collaborative has helped to increase their awareness of current trends in mathematics education. Teachers have indicated that this increased awareness has come from a variety of collaborative-sponsored activities, including the symposia, conferences, and institutes. Through these and other experiences, teachers have gained a fresh perspective on the mathematics curriculum. They approach the curriculum more creatively, have greater conviction regarding what should be in the curriculum, and have increased their expectations of what mathematics students can and need to learn.

The challenge of achieving a quality mathematics program is felt by all of the teachers; the collaborative is considered part of the solution in meeting this challenge. Representatives from business understand that having people with mathematical backgrounds and knowledge will be critical to the future of their companies. Collaborative mathematics teachers understand the importance of preparing their students for the world of work, and they have set high standards for their students. The

collaborative has provided a forum for these teachers where they can listen to each other, join together in cooperative activity, and make a difference. The mathematics supervisor observed that "mathematics reform is catching on." Still, there are teachers who feel that using calculators will mentally cripple their students and there is strong pressure from district administrators concerned with raising testing scores to conform to a skills-based curriculum. There are the increasingly worsening social conditions for many of the students. But because of the collaborative, a group of mathematics teachers, with strong encouragement by business and higher education, are working to make the mathematics education program achieve the highest quality.

Conclusions

The New Orleans Mathematics Collaborative has done very well in generating a model of collaboration to meet local conditions. This has been accomplished by garnering the support of influential people from business and higher education from the very beginning, by actively involving these people in meaningful ways during the development of the collaborative, and by building upon their interest to improve education in New Orleans. A strong group of mathematics teachers has emerged and become active in supporting high expectations for the mathematics program. The collaborative has brought information about what is happening in other districts in the nation to New Orleans and has given teachers a vision of what could be. Individual teachers have made changes in the curriculum and in their teaching. However, the new ideas have not yet spread sufficiently to have generated district-wide change. Even though many teachers feel that they have autonomy in their classroom in making decisions about what is taught, constraints imposed by the district still inhibited such large-scale changes in the mathematics program as making computers and calculators an integral part of teaching mathematics.

At the end of four years, the New Orleans Mathematics Collaborative had begun to achieve some of its goals in the effort to enrich the district's mathematics program. Through the collaborative, some teachers have already enriched their mathematics courses by including more technology and less emphasis on traditional topics such as statistics and probability. But this has not been accomplished across the district. A group of devoted teachers, energized by their collaborative participation and working together to create

significant changes in the mathematics program, has coalesced. In this regard, significant progress had been made in reaching the expectations set for the collaborative.

REFERENCES

Commission on the Physical Sciences, Mathematics, and Resources. (1984). Renewing United States mathematics: Critical resource for the future. Report of the ad hoc committee on resources for the mathematical sciences. Washington, DC: National Academy Press.

Mathematical Sciences Education Board (MSEB). (1989). Everybody counts: A report to the nation on the future of mathematics education. Washington, DC: National Academy Press.

Middleton, J. A., Pitman, A. J., Webb, N. L., Romberg, T. A., & Pittelman, S. D. (1991). Mathematics teachers' views about teaching as a profession: Final results of a four-year longitudinal study (Report from the UMC Documentation Project). Madison, WI: University of Wisconsin-Madison, Wisconsin Center for Education Research.

Middleton, J. A., Webb, N. L., Romberg, T. A., & Pittelman, S. D. (1990). Teachers' conceptions of mathematics and mathematics education (Report from the UMC Documentation Project). Madison, WI: University of Wisconsin-Madison, Wisconsin Center for Education Research.

Middleton, J. A., Webb, N. L., Romberg, T. A., Pittelman, S. D., Richgels, G. M., Pitman, A. J., & Fadell, E. M. (1989). Characteristics and attitudes of frequent participants in the Urban Mathematics Collaboratives: Results of the Secondary Mathematics Teacher Questionnaire (Report from the UMC Documentation Project). Madison, WI: University of Wisconsin-Madison, Wisconsin Center for Education Research.

National Commission on Excellence in Education. (1983). A nation at risk: The imperative for educational reform. Washington, DC: U.S. Department of Education.

National Council of Teachers of Mathematics. (1989). Curriculum and evaluation standards for school mathematics. Reston, VA: Author.

Pittelman, S. D., Webb, N. L., Fadell, E. M., Romberg, T. A., Pitman, A. J., & Sapienza, M. (1991). The UMC guide to documentation. Madison, WI: Wisconsin Center for Education Research.

Popkewitz, T. S., & Myrdal, S. (1991). Case studies of the Urban Mathematics Collaborative Project: A report to the Ford Foundation. Madison, WI: University of Wisconsin-Madison, Wisconsin Center for Education Research.

Romberg, T. A., & Pitman, A. J. (1985). Annual report to the Ford Foundation: The Urban Mathematics Collaborative Projects (Program Report 86-1). Madison, WI: Wisconsin Center for Education Research.

Romberg, T. A., Pitman, A. J., Pittelman, S. D., Webb, N. L., Fadell, E. M., & Middleton, J. A. (1988). Mathematics teachers' views about teaching as a profession: An initial assessment (Report from the UMC Documentation Project). Madison, WI: University of Wisconsin-Madison, Wisconsin Center for Education Research.

Romberg, T. A., Webb, N. L., Pitman, A. J., & Pittelman, S. D. (1987). 1986 Annual report to the Ford Foundation: The Urban Mathematics Collaborative Project (Program Report 87-4). Madison, WI: Wisconsin Center for Education Research.

Webb, N. L., Pittelman, S. D., Romberg, T. A., Pitman, A. J., Fadell, E. M., & Middleton, J. A. (1989). The Urban Mathematics Collaborative Project: Report to the Ford Foundation on the 1987-88 school year (Program Report 89-1). Madison, WI: Wisconsin Center for Education Research.

Webb, N. L., Pittelman, S. D., Romberg, T. A., Pitman, A. J., Middleton, J. A., Fadell, E. M., & Sapienza, M. (1990). The Urban Mathematics Collaborative Project: Report to the Ford Foundation on the 1988-89 school year (Program Report 90-1). Madison, WI: Wisconsin Center for Education Research.

Webb, N. L., Pittelman, S. D., Romberg, T. A., Pitman, A. J., & Williams, S. R. (1988). The Urban Mathematics Collaborative Project: Report to the Ford Foundation on the 1986-87 school year (Program Report 88-1). Madison, WI: Wisconsin Center for Education Research.

Webb, N. L., Pittelman, S. D., Sapienza, M., Romberg, T. A., Pitman, A. J., & Middleton, J. A. (1991). The Urban Mathematics Collaborative Project: Report to the Ford Foundation on the 1989-90 school year (Program Report 91-1). Madison, WI: Wisconsin Center for Education Research.

Yerushalmy, M. & Schwartz, J. (1985). Geometric Supposer [Computer Software]. Developed by Educational Development Center, Inc. Pleasantville, NY: Sunburst Communications.